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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/533,248	10/17/2005	Krishna Kiran Mukkavilli	873.0132.U1(US)	5304

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EXAMINER	
NGUYEN, TUAN HOANG	

ART UNIT	PAPER NUMBER
2618	

DATE MAILED: 12/15/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/533,248	MUKKAVILLI ET AL.	
	Examiner	Art Unit	
	Tuan H. Nguyen	2618	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 October 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-45* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-45* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Priority

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Information Disclosure Statement

2. The information disclosure statement (IDS) submitted on 04/29/2005 has been considered by Examiner and made of record in the application file.

Claim Rejections - 35 USC § 112

3. Claims 15, 19, 21, 23, 36, 38, and 43 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Consider claims 15 and 19, the formula renders the claims indefinite because the claim fails to clearly define what is the meaning of element "P_2".

Consider claims 21, 23, 36, 38, and 43, the formula renders the claims indefinite because the claim fails to clearly define what is the meaning of element "i", "n", and "N".

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 20, 22, 35, 37, 40-42, and 44 are rejected under 35 U.S.C. 102(e) as being anticipated by Pautler et al. (US PUB. 2003/0185309 hereinafter, "Pautler").

Consider claim 20, Pautler teaches a method of constructing a beamformer comprising the steps of: providing a unitary space-time constellation of at least one signal i having a coherence time T and one transmit antenna and applying the constellation as a set of at least one beamforming vectors in an array of T antennas (page 7 [0102]).

Consider claim 22, Pautler teaches a method of constructing a beamformer of N vectors comprising the steps of: providing a transmitter system having n transmit antennas (page 2 [0028]); forming a set of N functions in a unitary space time

constellation with one antenna and a coherence time of n (page 7 [0102]); and applying said set of N functions as a set of N beamforming vectors (page 1 [0017]).

Consider claim 35, Pautler teaches transceiver comprising: a receiver for receiving at least one signal i in a coherence interval T (page 7 [0102]); circuitry for applying a unitary space-time constellation of the at least one signal i as a set of at least one beamforming vectors in an array of T antennas (page 7 [0102]).

Consider claim 37, Pautler teaches transceiver comprising: a plurality of n transmit antennas (page 2 [0028]); circuitry for forming a set of N functions in a unitary space time constellation with one antenna and a coherence time of n (page 7 [0102]); and a transmitter for applying said set of N functions as a set of N beamforming vectors to a signal to be transmitted (page 1 [0017]).

Consider claim 40, Pautler teaches program of machine-readable instructions, tangibly embodied on an information bearing medium and executable by a digital data processor, to perform actions directed toward transmitting a beamformed signal, the actions comprising: quantizing at least two eigenvectors of a channel (page 6 [0096]); receiving over a wireless channel an indication of power allocation among the at least two eigenvectors (page 4 [0058]); and transmitting a signal along the at least two eigenvectors using a power allocation consistent with the received indication (page 8

[0114]).

Consider claim 41, Pautler further teaches quantizing at least two eigenvectors comprises calculating a dominant one of the two eigenvectors in a codebook that maximizes .parallel.H(C.sub.i.sup.1).sup..dagger..parallel..sub.2, said codebook also tangibly embodied on an information bearing medium (page 6 [0096]).

Consider claim 42, Pautler further teaches quantizing at least two eigenvectors comprises calculating a non-dominant one of the two eigenvectors by finding that vector in an orthogonal subspace to the dominant eigenvector that maximizes the inner product with a beamformer codebook in the orthogonal subspace to the said codebook (page 6 [0096]).

Consider claim 44, Pautler teaches transceiver comprising: a transmitter for sending over a channel a first message to a recipient (page 5 [0075]); a receiver for receiving a reply from the recipient, said reply comprising information concerning the channel (page 4 [0058]); a processor for beamforming a second message using the information, said second message being transmitted by the transmitter to the recipient along at least two eigenvectors (page 8 [0114]).

6. Claims 30-32 and 39 are rejected under 35 U.S.C. 102(e) as being anticipated by Kim et al. (US PUB. 2002/0013130 hereinafter, "Kim").

Consider claim 30, Kim teaches a transceiver comprising: first circuitry for quantizing at least two eigenvectors for a signal to be transmitted (page 1 [0014] and [0015]); second circuitry for quantizing a power allocation among the at least two eigenvectors in a manner that is independent of the quantizing the at least two eigenvectors (page 1 [0014] and [0015]); and a transmitter for transmitting the signal along the at least two eigenvectors with the quantized power allocation among the at least two eigenvectors (page 1 [0014] and [0015]).

Consider claim 31, Kim further teaches the first circuitry comprises a receiver for receiving a wireless message that includes the quantized power allocation (page 5 [0073]).

Consider claim 32, Kim further teaches the power for the dominant eigenvector is P_1 and for a less dominant eigenvector is P_2, the power allocation being $P_1 = kP_2$; where k is selected from the group 1, 0.5, 0.2, and 0 (page 2 [0034]).

Consider claim 39, Kim teaches program of machine-readable instructions, tangibly embodied on an information bearing medium and executable by a digital data processor, to perform actions directed toward determining a parameter usable for beamforming, the actions comprising: for a channel matrix that is representative of a channel over which a signal was received, estimating a parameter in the channel matrix

by selecting the value of a parameter in a codebook that minimizes a criterion, wherein the codebook is also tangibly embodied on an information bearing medium (page 3 [0061] and page 6 [0084] and [0085]).

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 1-14, 16-18, 24, 25-29, and 33-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pautler et al. (US PUB. 2003/0185309 hereinafter, "Pautler") in view of Kim et al. (US PUB. 2002/0013130 hereinafter, "Kim").

Consider claims 1 and 24, Pautler teaches a method of forming a beam of a signal to be transmitted from a base station transceiver in a communication system having a communication channel between a base station and a mobile station and a return channel for data transmitted from the mobile station to the base station, the method comprising: providing a codebook (C) of parameters that modify a transmitted signal (page 5 [0075]): providing a channel matrix (H) of parameters representing the properties of the channel (page 5 [0078]); transmitting a signal from the base station along a channel using an antenna comprising at least two elements (page 8 [0114]);

transmitting an indication of the selected parameter over the return channel (page 4 [0058]); and applying the codebook vector associated with the selected parameter to subsequent transmissions from the base station (page 5 [0075]).

Pautler does not explicitly show that receiving said transmitted signal in said mobile station and estimating a parameter in the channel matrix characteristic of the channel by selecting the value of a parameter in the codebook that minimizes a criterion.

In the same field of endeavor, Kim teaches receiving said transmitted signal in said mobile station and estimating a parameter in the channel matrix characteristic of the channel by selecting the value of a parameter in the codebook that minimizes a criterion (page 3 [0061] and page 6 [0084] and [0085]).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use, receiving said transmitted signal in said mobile station and estimating a parameter in the channel matrix characteristic of the channel by selecting the value of a parameter in the codebook that minimizes a criterion, as taught by Kim, in order to provide an optimum weight estimator of a mobile station in a mobile communication system in which a base station uses closed transmit diversity technology.

Consider claims 2 and 8, Pautler further teaches an eigenvector of said channel matrix is provided by a calculation based on said parameter (page 1 [0016] and [0017]).

Consider claims 3, 6, 9, and 12 Kim further teaches calculation is performed in said mobile station (page 5 [0075]).

Consider claims 4 and 10, Kim further teaches base station transmits a set of initial setup signals that are used by the mobile station to estimate the parameters of the channel (page 5 [0080]).

Consider claims 5 and 11, Kim further teaches an eigenvector of said channel matrix is provided by a calculation based on said parameter (page 4 [0071]).

Consider claim 7, Kim further teaches the signal is divided into frames and the process of estimating a parameter, transmitting an indication of the selected parameter and applying the codebook vector is repeated for each frame (page 4 [0069] and [0070]).

Consider claim 13, Pautler teaches a method of forming a beam of a signal to be transmitted from a base station transceiver in a communication system having a communication channel between a base station and a mobile station having two antennas and a return channel for data transmitted from the mobile station to the base station, the method comprising: providing a codebook (C) of parameters that modify a transmitted signal: providing a channel matrix (H) of parameters representing the properties of the channel (page 5 [0075]).

Pautler does not explicitly show that transmitting a signal from the base station along two eigenvectors of a channel, the power allocation between said two eigenvectors being quantized independently from the quantization of the eigenvectors.

In the same field of endeavor, Kim teaches transmitting a signal from the base station along two eigenvectors of a channel, the power allocation between said two eigenvectors being quantized independently from the quantization of the eigenvectors (page 1 [0014] and [0015]).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use, transmitting a signal from the base station along two eigenvectors of a channel, the power allocation between said two eigenvectors being quantized independently from the quantization of the eigenvectors, as taught by Kim, in order to provide an optimum weight estimator of a mobile station in a mobile communication system in which a base station uses closed transmit diversity technology.

Consider claims 14 and 18, Pautler further teaches the quantization of the power allocation is performed at the receiver (page 6 [0087] and [0088]).

Consider claim 16, Pautler further teaches the dominant eigenvector is quantized by calculating the eigenvector in the relevant codebook that maximizes .parallel.H(C.sub.i.sup.1).sup..dagger..parallel..sub.2 (page 6 [0093]).

Consider claim 17, Pautler further teaches the second of two eigenvectors is calculated by finding that vector in an orthogonal subspace to the first eigenvector that maximizes the inner product with a beamformer codebook in the orthogonal subspace to the said relevant codebook (page 6 [0093]).

Consider claim 25, Pautler teaches a transceiver comprising: a receiver for receiving a first signal from a sender over a channel from at least two transmit antennas (page 4 [0064]); a computer readable storage medium for storing a codebook C of parameter (page 5 [0075]); and a transmitter for transmitting to the sender an indication of the selected value of the parameter prior to receiving a second signal from the sender (page 4 [0068]).

Pautler does not explicitly show that circuitry coupled to the codebook and to the receiver for estimating a parameter of a channel matrix of the channel by selecting a value of a parameter in the codebook that minimizes a criterion.

In the same field of endeavor, Kim teaches circuitry coupled to the codebook and to the receiver for estimating a parameter of a channel matrix of the channel by selecting a value of a parameter in the codebook that minimizes a criterion (page 3 [0061] and page 6 [0084] and [0085]).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use, circuitry coupled to the codebook and to the receiver for estimating a parameter of a channel matrix of the channel by selecting a value of a parameter in the codebook that minimizes a criterion, as taught by Kim, in

order to provide an optimum weight estimator of a mobile station in a mobile communication system in which a base station uses closed transmit diversity technology.

Consider claim 26, Pautler further teaches circuitry further is for determining an eigenvector of said channel matrix based on the estimated parameter (page 5 [0070]).

Consider claim 27, Kim further teaches circuitry estimates the parameter of the channel matrix using a set of initial setup signals received with the first signal (page 5 [0080]).

Consider claim 28, Kim further teaches the circuitry is for estimating a parameter of a channel matrix of the channel by selecting a value of a parameter in the codebook that minimizes a criterion for each frame of received signals (page 3 [0061] and page 6 [0084] and [0085]).

Consider claim 29, Pautler further teaches the transceiver of claim 1 disposed within a mobile station (page 4 [0064]).

Consider claim 33, Pautler further teaches the first circuitry quantizes a dominant eigenvector of the at least two eigenvectors by calculating that eigenvector in a codebook C that maximizes .parallel.H(C.sub.i.sup.1).sup..dagger..parallel..sub.2 for a

channel matrix H (page 6 [0093]).

Consider claim 34, Pautler further teaches the first circuitry quantizes a non-dominant eigenvector of the at least two eigenvectors by finding that vector in an orthogonal subspace to the dominant eigenvector that maximizes an inner product with a beamformer codebook in the orthogonal subspace to the said codebook C (page 6 [0093]).

Consider claim 45, Kim further teaches the information comprises an indication of a value of a parameter in a codebook that minimizes a criterion (page 6 [0084] and [0085]).

Conclusion

9. Any response to this action should be mailed to:

Mail Stop_____ (Explanation, e.g., Amendment or After-final, etc.)

Commissioner for Patents

P.O. Box 1450

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Facsimile responses should be faxed to:

(571) 273-8300

Hand-delivered responses should be brought to:

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Randolph Building

401 Dulany Street

Alexandria, VA 22313

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tuan H. Nguyen whose telephone number is (571) 272-8329. The examiner can normally be reached on 8:00Am - 5:00Pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Maung Nay A. can be reached on (571) 272-7882. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information Consider the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Tuan Nguyen T.P
Examiner
Art Unit 2618

12/04/06

QUOCHIEN B. VUONG
PRIMARY EXAMINER